3M™ Electrically Conductive Adhesive Transfer Tape 9704

Product Description

3M™ ECATT 9704 is a high adhesion pressure sensitive adhesive (PSA) transfer tape with anisotropic electrical conductivity. Filled with silver particles enabling connectivity through adhesive thickness (the Z-axis) between substrates.

3M ECATT 9704 is designed to have lower typical outgassing residuals as compared to a similar type conductive adhesive product, such as 3M™ Electrically Conductive Adhesive Transfer Tape 9705.

3M ECATT 9704 electrically connects and adhesively bonds medium pitch flexible circuits with other flexible circuits (flex), rigid printed circuit boards (PCB) or LCD screens. 3M ECATT 9704 offers good adhesion to common PCB substrates such as gold, FR-4 epoxy, polyimide and polyester films. Stable electrical performance in any flexible circuit interconnection application may require added mechanical reinforcement (clamping or compressing) in the bond area.

3M ECATT 9704 also electrically connects and adhesively bonds EMI/RFI shield and gaskets to metal frames and enclosures. The low contact resistance and tape construction result in good EMI performance. 3M ECATT 9704 can be applied as die cut parts or in roll form and has good adhesion to common EMI/RFI substrates such as, plated surfaces, stainless steel, and smooth gasket materials.

3M ECATT 9704 is a more surface aggressive ECATT on many substrates which will allow a higher level of adhesion build as measured via a peel adhesion test method and as compared to the 3M™ Electrically Conductive Adhesive Transfer Tapes 9703 or 9705. As 3M ECATT 9704 is a more aggressive ECATT tape, it is generally not compatible with Indium Tin Oxide (ITO) coatings or other easily corroded surfaces.

Features and Benefits

- Low out gassing acrylic adhesive
- Anisotropic Z-axis electrical conductivity
- No thermal curing needed
- Easy to use in assembly operations
- Can be applied as die-cut parts or in roll form

Product Construction

Property	Value
Adhesive Type	Filled Acrylic Pressure Sensitive
Release Liner	Silicone-treated Polyester liner (PET)
Approximate Thickness	
Adhesive	2 mil (50 µm)
Liner	PET = 2 mil (50 µm)

Typical Physical Properties and Performance Characteristics

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Adhesive Properties:

Peel Adhesion to Stainless Steel:
(Test Method is based on a modified ASTM D3330, 12 ipm peel rate, 1 in. width, 2 mil PET backing, 180 degree)

Dwell Time @ Room Temperature	1 Hour	24 Hours
23°C	36 oz./in. (3.9 N/cm)	51 oz./in. (5.6 N/cm)

Note: Peel values will often be higher than noted above when using a non-PET backing. Different backing types effect the backing modulus, thickness and stiffness and these differences directly effect the peel test result value. As an example, a 2 mil aluminum backing will change the test value of the peel adhesion as the peel back angle at the interface will change due to the backing stiffness. A 2 mil aluminum backing would generally increase the peel values.

Temperature Performance[1]	Application Use Temperatures: -40 to +85°C in a properly designed end use application. See Note 1. Application Storage Temperatures: See "Shelf Life and Storage" comments. End user needs to qualify converted material for a broader storage environmental range. See also the Application section of this document

Outgassing:
The outgassing test for the 3M™ Electrically Conductive Adhesive Transfer 9704 is based on a 3M Test Method that measures the Total Mass Loss (TML) via outgassing excluding water, that can be referred to as the Collected Volatile Condensable Material (CVCM) based on a Head Space (HS) Temperature and Time as is commonly applied in a GC-HS analysis. The Head Space Time, Temperature, sample preparation, etc. can vary with specifics of test methods and so results can vary between test methods. The CVCM of the 3M ECATT 9704 is typically < 50% of the CVCM of the standard ECATT product 9705 based on the 3M TM.

Electrical Properties:

Contact Resistance[1]	< 0.3 ohms (3M Test Method, Gold PI Flex onto Gold PCB, RT Initial R, 6 mm^2)
Minimum Gap[2]	15 mil (0.4 mm)
Minimum Overlap Area[3]	5000 mil^2 (3.2 mm^2)

[1] The final assembly must be tested to verify that the 3M™ Electrically Conductive Adhesive Transfer Tape 9704 can achieve the desired performance in the assembly's end use application environmental conditions (temperature, humidity, temperature cycling, shock, application assembly design, assembly variation, etc.). 3M ECATT 9704 may achieve the -40 to +85°C temperature range (or broader temperature range excursions) in an end use application if the final assembly design is designed so that the conductive particles remain in sufficient mechanical contact between surfaces to achieve the desired contact resistance. Some type of mechanical bond line compression design as determined by the end use customer (clip, clamp, screw, compressed foam, etc.) that will apply a constant minimum pressure across the bond line may be required to meet the desired end use environmental ranges and contact resistance specification. The temperature use range is dictated by two primary items: Temperature performance of the acrylic adhesive (generally in the range of -40°C to about 95°C depending on other environmental conditions) as it supports the conductive particles in the adhesive/ particle matrix and the potential movement of the conductive fillers in the adhesive system in an end use application design. Items contributing to the performance of the 3M ECATT 9704 for resistance level performance include, but are not limited to: assembled bond line force (constant force present across the bond line after assembly and over the life of the product), types of substrates bonding, surface features in bonded area, environmental conditions, (temperature, humidity, CTE, shock, environmental cycling, etc.), assembly surfaces and 3M ECATT 9704 compatibility, 3M ECATT 9704 filler and assembly surfaces galvanic potential compatibility, etc. (See section on mechanical clamping for added information).

[2] Minimum free space between adjacent conductors suggested to ensure electrical isolation. Customers may qualify finer pitch performance in their applications.

[3] Minimum recommended conductor overlap area (pad area) in the interconnection of individual circuit lines to ensure Z-Axis conduction.

Available Sizes

Slit Tape Width	Standard Length	Maximum Length
0.25 to 0.5 inch (6.9 mm to 13 mm)	36 yds. (32.9 m)	36 yds. (32.9 m)
0.5 to 24 inch (13 mm to 609 mm)	36 yds. (32.9 m)	108 yds. (98.8 m)
Normal Slitting Tolerance	0.03125 in. (0.8 mm)	

Application Techniques

Bonding

- To obtain maximum adhesion, the bonding surfaces must be clean and dry.
- Pressure must be applied to the bond line after assembly to wet the substrates with 3M™ Electrically Conductive Adhesive Transfer Tape 9704 and to engage the conductive particles with the substrates to make electrical connection. Mechanical pressure (roller, metal bar) or finger pressure at 5 to 15 psi (0.03 to 0.10 Mpa) is suggested at 20°C (68°F) to 25°C (77°F). The end user may find through testing that a higher pressure could be more effective in their end use design to meet their specific design criteria. Heat may be applied simultaneously to improve wetting and final bond strength. **See Note A.**
- 3M ECATT 9704 is suggested to be applied at a maximum temperature range not to exceed 15°C - 70°C (60°F - 158°F). Tape application below 10°C (50°F) is not suggested because the adhesive will be too firm to wet the surface of the substrate, resulting in low adhesion. **See Note A.**
- Adhesion builds with time, up to 24 to 72 hours may be required to reach final adhesion values.

Note A) Regarding the application of Temperature, Pressure and Time (T-P-T) during assembly and/or lamination: Care must be taken by the end user during assembly as the modulus of the tape will be reduced with the application of heat.

- An application method with ranges of not more than: 5-15 psi @ 15-70°C for 2-30 seconds is suggested as a set of initial evaluation ranges. An example of initial T-P-T that may be evaluated is: 8 psi applied via an assembly fixture using an air actuated pressure pad (pad is a medium firm elastomer) for 5 seconds @ 23°C. The end user may find assembly T-P-T outside these limits works well in their unique application. The noted T-P-T is a suggested starting point of tape bonding criteria and will be influenced by 3M ECATT 9704 part size, substrate types, substrate modulus, surface features, flatness, assembly fixtures, etc.
- Final bond strength and conductive performance will be impacted by how Temperature-Pressure-Time interact in an end use assembly method to the desired substrates.
- Care must be used to minimize excessive “Temperature-Pressure-Time” assembly methods as they are applied to the tape during assembly so that the conductive filler/acrylic adhesive matrix is not damaged leading to poor performance (ie: excessive squeeze-out of tape, filler-interface damage, minimize over compression and conductive filler/adhesive matrix damage.)
- A Design of Experiments (DOE) is suggested to establish the optimum bonding conditions for each application assembly.

Application Techniques (continued)

Mechanical Clamping

To assure electrical resistance stability of 3M™ Electrically Conductive Adhesive Transfer Tape 9704 in any flexible circuit interconnection application, or grounding application between various types of substrates, a mechanical clamp or other compressive force (i.e. foam strip held in compression over bond area.) should be considered in the design of the application. Any stress inherent in the assembly design (i.e. tensile, shear, cleavage) or temperature excursions (encountered through normal product use) applied to the bond area could result in an electrical open in the bonded circuit over time when no clamp or mechanism for maintaining a constant compressive forces is used. A well designed mechanical clamp will reduce the environmental stress on the bond line and improve the electrical reliability of the bond. In addition, the temperature operating range for the adhesive can be improved with a properly designed mechanical clamping system to ensure the conducting particles in the 3M ECATT 9704 maintain electrical contact. Several types of mechanical clamps have been used successfully including foam strips attached to lids or cases and screw-attached plastic clamps. Contact your 3M technical service representative for further information about mechanical clamping.

Temperature Performance

The electrical performance of 3M ECATT 9704 is more sensitive to environmental changes than is the peel adhesion performance. Contact resistance performance may be compromised, even if holding power is not significantly affected. See note 1 in “Electrical Properties” section. The user is responsible for the environmental performance qualification of 3M ECATT 9704 in their design.

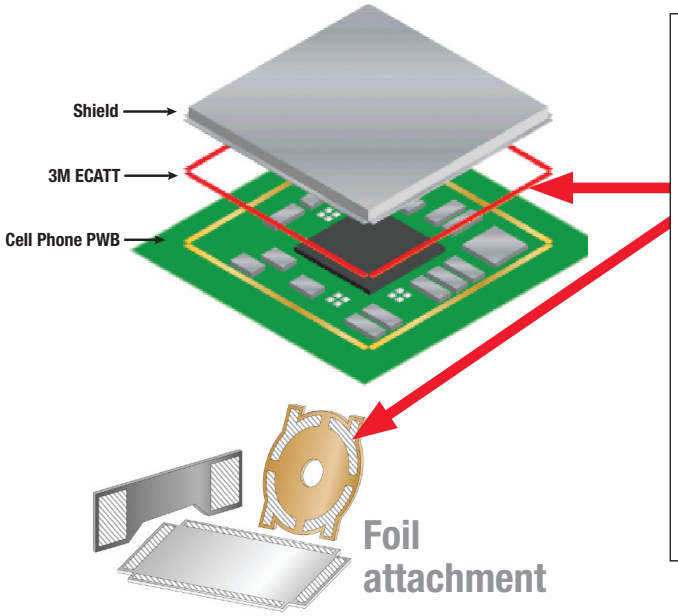
Rework

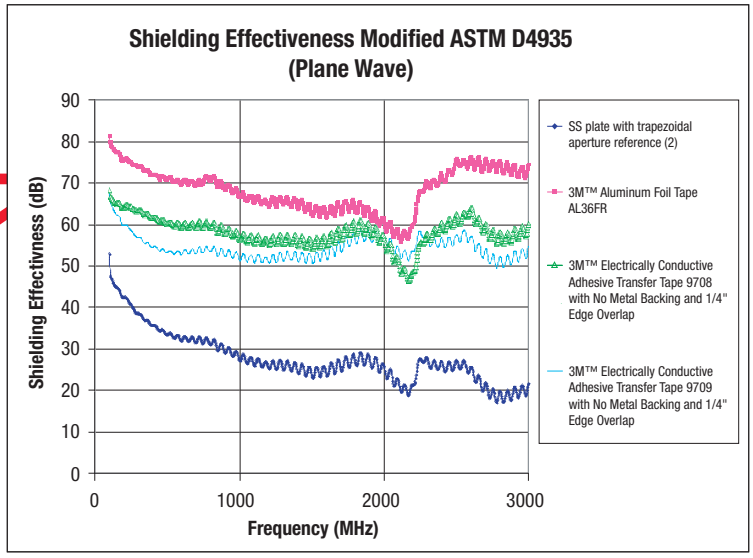
Mechanically separate the parts using torque (for rigid parts) and peel (for flexible parts). Remove the adhesive by rubbing it off with a Scotch-Brite™ Hand Pad, clean up the site, and apply new adhesive. The force needed to separate the parts and/or remove the adhesive can be reduced by softening the adhesive by heating 70°C - 100°C (158°F - 212°F) or using solvents.*

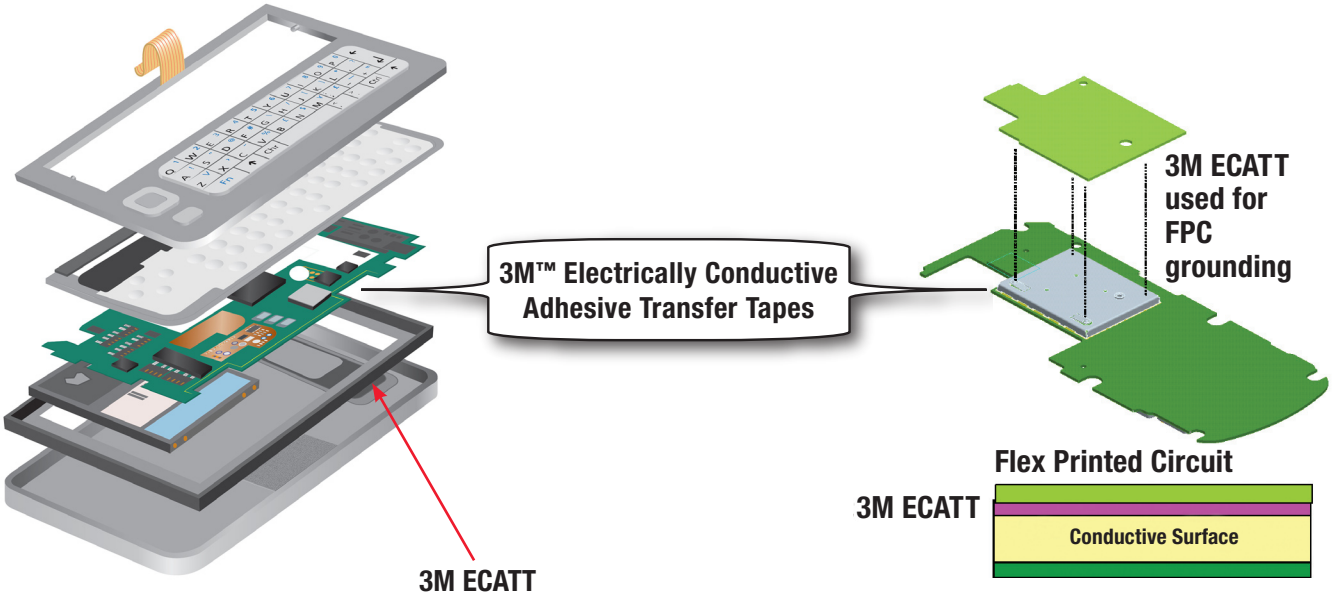
***Note:** When using solvents, be sure to follow the manufacturer’s precautions and directions for use when handling such materials.

3M™ Tape Application Benefits

3M™ Electrically Conductive Adhesive Transfer Tapes (ECATT) provide grounding and EMI shielding through the bond line thickness leading to improved product EMI shielding performance. 3M ECATT 9704 may provide EMI shielding in the bond line, but actual performance depends on the final design tape width.







General Information

3M™ Electrically Conductive Adhesive Transfer Tapes 9703, 9704 and 9705 are part of a family of anisotropic (Z-Axis) conductive tapes and thermoset films. For applications where mechanical clamping is not desired, or where improved electrical, thermal and mechanical performance is required, these alternative thermoset products should be considered.

Application Ideas

3M™ Electrically Conductive Adhesive Transfer Tape 9704 is ideal for interconnection of flexible circuits with other flexible circuits (flex), rigid printed circuit boards (PCB) or LCD screens. Applications include polyester flex circuit splicing, keyboard manufacturing, LCD assembly and many others. 3M ECATT 9704 is also ideal for EMI/RFI shield and gasket attachment applications. Applications include EMI shields for displays and gasket attachment to EMI/RFI cabinets and enclosures.

Shelf Life and Storage

The shelf life of 3M ECATT 9704 is 24 months from the shipment date from the manufacturing location when stored in roll form in original packaging at 21°C (70°F) and 50% relative humidity.

Regulatory

For regulatory information about this product, contact your 3M representative.

Technical Information

The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

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3M

Electronics Materials Solutions Division
3M Center, Building 225-3S-06
St. Paul, MN 55144-1000
1-800-251-8634 phone
651-778-4244 fax
www.3M.com/electronics

60-5002-0511-1

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